

We claim:

1                    1.     A thermal barrier coating comprising rare-earth element  
2 phosphate.

1                    2.     The thermal barrier coating according to Claim 1 further  
2 comprising a monazite or xenotime crystal structure.

1                    3.     The thermal barrier coating according to Claim 1, wherein  
2 the ratio between rare-earth element and phosphate is about 1:1.

1                    4.     The thermal barrier coating according to Claim 1 having a  
2 thickness between 10 and 500 micrometers.

1                    5.     The thermal barrier coating according to Claim 1  
2 deposited on a substrate having a temperature between 600°C and  
3 1100°C.

1                    6.     The thermal barrier coating according to Claim 5  
2 deposited on a substrate having a temperature between 750°C and 950°C.

1                    7. The thermal barrier coating according to Claim 1 formed  
2 by a process selected from the group consisting of chemical vapor  
3 deposition, physical vapor deposition, electron beam evaporation, pulsed  
4 electron beam evaporation, laser ablation, and plasma spraying.

1                    8. The thermal barrier coating according to Claim 7 using  
2 single or multiple sources of materials selected from the group consisting of  
3 rare-earth phosphates and mixtures of rare-earth precursors with  
4 phosphorous precursors.

1                    9. The thermal barrier coating according to Claim 1 formed  
2 with a columnar microstructure.

1                    10. The thermal barrier coating according to Claim 1 formed  
2 with a porous microstructure.

1                    11. The thermal barrier coating according to Claim 1, wherein  
2 the phosphate is lanthanum phosphate.

1                    12. The thermal barrier coating according to Claim 1  
2 deposited on one of a ceramic substrate and a metallic substrate.

1                    13. The thermal barrier coating according to Claim 12,  
2 wherein the metal substrate is a nickel-based superalloy, an iron-based  
3 superalloy or a cobalt-based superalloy.

1                    14. The thermal barrier coating according to Claim 13 further  
2 comprising a layer of aluminum phosphate disposed between the rare-earth  
3 element phosphate and the metal substrate.

1                    15. The thermal barrier coating according to Claim 13 further  
2 comprising a layer of alumina between the metallic substrate and said rare-  
3 earth element phosphate.

1                    16. The thermal barrier coating according to Claim 15 further  
2 comprising a region of rare-earth aluminate between the alumina and said  
3 rare-earth element phosphate.

1                    17. The thermal barrier coating according to Claim 1  
2 comprising a mixture of lanthanum phosphate, cerium phosphate and  
3 neodymium phosphate.

1 18. A thermal barrier coating comprising lanthanum  
2 phosphate.

1 19. The thermal barrier coating according to Claim 18 further  
2 comprising a monazite crystal structure.

1 20. The thermal barrier coating according to Claim 18,  
2 wherein the ratio between lanthanum and phosphate is about 1:1.

1 21. The thermal barrier coating according to Claim 18 having  
2 a thickness between 10 and 500 micrometers.

1 22. The thermal barrier coating according to Claim 18  
2 deposited on a substrate having a temperature between 600°C and  
3 1100°C.

1 23. The thermal barrier coating according to Claim 22  
2 deposited on a substrate having a temperature between 750°C and 950°C.

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1                   24. The thermal barrier coating according to Claim 18 formed  
2 by a process selected from the group consisting of chemical vapor  
3 deposition, physical vapor deposition, electron beam evaporation, pulsed  
4 electron beam evaporation, laser ablation, and plasma spraying.

5                   25. The thermal barrier coating according to Claim 24 using  
6 single or multiple sources of materials selected from the group consisting of  
7 rare-earth phosphates and mixtures of rare-earth precursors with  
8 phosphorous precursors.

1                   26. The thermal barrier coating according to Claim 18 formed  
2 with a columnar microstructure.

1                   27. The thermal barrier coating according to Claim 18 formed  
2 with a porous microstructure.

1                   28. The thermal barrier coating according to Claim 18  
2 deposited on one of a ceramic substrate and a metallic substrate.

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1                    29. The thermal barrier coating according to Claim 28,  
2 wherein the metal substrate is a nickel-based superalloy, an iron-based  
3 superalloy or a cobalt-based superalloy.

1                    30. The thermal barrier coating according to Claim 29 further  
2 comprising a layer of aluminum phosphate disposed between the lanthanum  
3 phosphate and the metal substrate.

1                    31. The thermal barrier coating according to Claim 29 further  
2 comprising a layer of alumina between the metallic substrate and the  
3 lanthanum phosphate.

1                    32. The thermal barrier coating according to Claim 31 further  
2 comprising a region of lanthanum aluminate between the alumina and the  
3 lanthanum phosphate.

1                    33. The thermal barrier coating according to Claim 18  
2 comprising a mixture of lanthanum phosphate, cerium phosphate and  
3 neodymium phosphate.

1                    34. A thermal barrier coating comprising a mixture of rare-  
2 earth element phosphates and refractory oxides.

1                    35. The thermal barrier coating according to Claim 34 having  
2 a thickness between 10 and 500 micrometers.

1                    36. The thermal barrier coating according to Claim 34  
2 deposited on a substrate having a temperature between 600°C and  
3 1100°C.

1                    37. The thermal barrier coating according to Claim 34 formed  
2 by a process selected from the group consisting of chemical vapor  
3 deposition, physical vapor deposition, electron beam evaporation, pulsed  
4 electron beam evaporation, laser ablation, and plasma spraying.

5                    38. The thermal barrier coating according to Claim 34 formed  
6 with a columnar microstructure.

1                    39. The thermal barrier coating according to Claim 34 formed  
2 with a porous microstructure.

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1                   40. The thermal barrier coating according to Claim 34  
2 deposited on one of a ceramic substrate and a metallic substrate.

1                   41. The thermal barrier coating according to Claim 40,  
2 wherein the metal substrate is a nickel-based superalloy, an iron-based  
3 superalloy or a cobalt-based superalloy.

1                   42. The thermal barrier coating according to Claim 41 further  
2 comprising a layer of aluminum phosphate disposed between the mixture  
3 and the metal substrate.

1                   43. The thermal barrier coating according to Claim 41 further  
2 comprising a layer of alumina between the metallic substrate and the  
3 mixture.

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